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ABSTRACT

This paper reports on a computer initiative implemented by a metropolitan school district in Virginia. The initiative began in 1995 when the school district of 44,000 students funded 5 computers and a color printer for each elementary classroom in 34 schools. The goals of the initiative focused on: increasing student performance; addressing different learning styles; providing students with daily access to computers; increasing student proficiency with computers; and preparing students for the future. To accomplish these goals, teachers were required to acquire the capacity to integrate computers into their daily classroom lessons, and the school division needed to install and maintain the hardware and courseware required to support teacher efforts. Data were collected through classroom observations, teacher surveys, and focus group interviews. Data were then organized and analyzed to examine the impact of computers on teacher capacity to integrate computers into their instructional strategies, attitudes, and beliefs, and teacher instructional and work behaviors. The implementation of the initiative was evaluated in each of the three years since 1995 in order to provide information to the school district for use in planning, work tasks, and staff development. Teacher attitudes, ability, and instructional behaviors were sampled, as well as their perceptions of student motivation and performance due to the initiative. Student achievement was not reviewed until the third year of the study. A copy of the teacher questionnaire is appended. (Author/MES)

The Impact of Computers on Teacher Capacity, Attitudes, and Behaviors in Elementary Schools

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The Impact of Computers on Teacher Capacity, Attitudes, and Behaviors in Elementary Schools

Abstract

This paper reports on a three-year Computer Initiative implemented by a metropolitan school district in the Commonwealth of Virginia. The Initiative began in 1995, continued through 1998 and continues today. The Initiative began when the school district of 44,000 students funded five computers and an ink jet color printer in each elementary classroom in thirty-four schools. The goals of the initiative were numerous but focused on: (1) increasing student performance, (2) addressing different learning styles, (3) providing students with daily access to computers, (4) increasing student proficiency with computers, and (5) preparing students for the future. To accomplish these goals, teachers were required to acquire the capacity to integrate computers into their daily classroom lessons and the school division needed to install, and subsequently, maintain the technical hardware and courseware required to support teacher efforts.

Data were collected through classroom observations, teacher surveys, and focus group interviews. Data were then organized and analyzed to examine the impact of computers on teacher capacity to integrate computers into their instructional strategies, attitudes and beliefs behavior and teacher instructional and work behaviors. The implementation of the Initiative was evaluated in each of the three years since 1995 in order to provide information to the school district for use in planning, work tasks and staff development. Teacher attitudes, ability, and instructional behaviors were sampled as well as their perceptions of student motivation and performance due to the Initiative. Student achievement was not reviewed until the third year of the study. It was, and is, thought that the full impact of the Initiative on student achievement will not be achieved until at least the fifth year of the Initiative.

The major findings from the study are summarized below:

- Teacher capacity to integrate computers into their instructional strategies dramatically improved since beginning of initiative. Non Technology users were eliminated after the first year.
- Teachers were satisfied with: (1) the process of working with students on computers; (2) the increased knowledge about technology; (3) the importance of initiative to teacher work; and, (4) the progress thus far.
- Beliefs remain that: (1) school is getting most out of initiative; and, (2) it is worth the cost and time.
- Computers were primarily used to improve language arts, reading, and writing skills.
- Instructional focus was placed on: (1) challenging high ability students and (2) improving student directed learning, rather than remediating deficiencies.
- Instructional delivery significantly changed by: (1) being better able to present more complex material; (2) using a more thematic approach; (3) using less lecture and whole class instruction; and, (4) utilizing more small group instruction. Instructional delivery improved by teachers being able to present more complex material.
- Teacher work behavior changed by: (1) discussing how to integrate computers into subject matter delivery, and (2) producing better teacher products

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Purpose

In 1996, a metropolitan school district of 44,000 students placed five computers and an ink jet color printer (the Computer Initiative) in each regular first through fifth grade classrooms in thirty-four elementary schools. The goals of the Initiative were numerous but focused on: (1) increasing student performance, (2) addressing different learning styles, (3) providing students with daily access to computers, (4) increasing student proficiency with computers, and (5) preparing students for the future. To accomplish these goals, teachers were required to acquire the capacity to integrate computers into their daily classroom lessons, and the school district needed to install, and subsequently maintain, the technical hardware and software required to support teacher efforts.

At the time of implementation, the district commissioned a three year longitudinal study to determine the impact of the Computer Initiative on teacher behavior. It has long been assumed that technology can help create a rich learning environment if it is integrated into teacher instructional strategies. For example, Seidel (1980) pointed out that teachers at different levels of sophistication will have varying objectives and goals for the use of technology in their classrooms. However, this potential depends upon the teacher's ability to integrate the technology into everyday classroom activities. As Pisapia, Schlesinger, and Park's (1993) exhaustive review of the literature noted, technology can have an impact on teaching style, instructional philosophy and goals, classroom organization, and student behavior. Furthermore, these elements are impacted by training, instructional materials, resource allocations, and organizational press. The review also pointed out that the effort that teachers expend to integrate technology seamlessly into their instruction is also affected by their attitudes, skills, and knowledge.

The central focus of this study was to determine the impact of introducing five

computers into elementary classrooms on teacher computer ability, attitudes, instructional behaviors, and work behaviors. The following research questions guided the investigation.

- What impact has the Initiative had on the teachers' capacity to integrate computer assisted instruction into their instruction?

- What impact has the Initiative had on teacher attitudes and beliefs regarding the role and use of computers in their instruction?

- What impact has the Initiative had on teacher instructional behaviors?

- What impact has the Initiative had on teacher work behaviors?

Methodology

Thirty-four elementary schools took part in the Initiative. In the first year of the study, a sample of eight of these thirty-four schools was randomly selected for in-depth analyses over the three-year period. Data were collected on this sample each year of the study through classroom observations, focus group interviews, teacher surveys, and software-usage surveys.

Designing the research project as a longitudinal study provided information on how technology is being assimilated and accommodated in the instructional environment. As Seidel and Perez (1994) noted, longitudinal studies enable the researcher to observe how teacher behavior, purposes, and attitudes might change over time.

During each of the first three years, a report was generated which sampled teacher attitudes, ability, and instructional behaviors as well as their perceptions of student motivation and performance which they attributed to the Initiative. The school district then used this information formatively to improve the use of computers over the period of implementation in the elementary schools. At the end of the third year, a summative report was prepared to determine the impact of the Initiative on teacher behavior over the three year period.

Teacher behavior was assessed by the use of surveys, classroom observation instruments, and focus group interview guides. These instruments, created with an expert panel, were pilot-tested with a group of thirty teachers in the first year of the study. After each year, the three data sources were reviewed by teacher focus groups, and improvements were made to the instruments.

Each year, for three years, teachers from first through fifth grade in the randomly selected schools completed the 113-item teacher behavior survey (Appendix A). It is on these responses that the majority of this paper is based. In addition, principals and computer contacts from these schools completed a brief survey assessing their perspectives of the Initiative's impact. Then classroom observation reports and the focus group interviews were thematically analyzed to enrich the survey data. Some recurring themes surfaced during the interviews and are briefly addressed in this paper.

Teacher responses from the sample schools are the bases of the results discussed in this report. Sixty-one percent (61%) of the teachers in the eight randomly selected schools (N=87) completed the 113-item survey developed for the project by the Metropolitan Educational Research Consortium (MERC) in conjunction with school division personnel and reviewed by a panel of experts. Table 1 provides a description of the teachers who responded to the third year survey. The description of teachers who completed the survey in 1998 compare favorably with those who completed the survey in 1997 and 1996.

[Table I about here]

The average teacher responding to the surveys is: (1) female (93%) and Caucasian (82%); (2) holds an undergraduate education major (77%); (3) has taught for over fourteen years in a self-contained classroom (46%); (4) has a computer at home (74%); (5) has used computers in their teaching for three to five years (46%) and; (6) has been self-taught in computers by attending conferences and workshops on their own time (75%), and from receiving training from other teachers and the district's Technology Instructors.

The survey data were first analyzed through descriptive statistics and displayed in tables for each question at aggregate and grade levels. Then, the responses of teachers in 1998 were compared by a repeated measures design to 1996 and 1997 survey results to determine if significant changes had occurred from year one to year

Table 1:
Characteristics of Teachers Responding to the Survey during the Third Year by Grade Level

#	Question	RM	Total	Grade Level				
				1	2	3	4	5
1	**Gender**	M	6%	0%	0%	10%	11%	7%
	M=Male F=Female	F	94%	100%	100%	90%	89%	93%
2	**Ethnic Group**	C	82%	82%	84%	75%	83%	93%
	C=Caucasian; AA=African American; O=Other	AA	15%	14%	8%	25%	17%	7%
		O	2%	4%	8%	0%	0%	0%
3	**Undergraduate Major Degree**	ED	80%	86%	73%	74%	83%	79%
	ED = Education; LA = Liberal Arts;	LA	6%	5%	0%	11%	6%	7%
	PY = Psychology; SC = Science	PY	8%	5%	18%	5%	6%	14%
	O = Other	SC	1%	0%	9%	0%	0%	0%
		O	5%	4%	0%	10%	5%	0%
4	**Number of Years Teaching**	<2	12%	23%	0%	15%	12%	0%
		3-5	15%	4%	18%	15%	11%	36%
		6-9	15%	14%	37%	15%	11%	7%
		10-13	11%	9%	9%	20%	11%	0%
		>14	47%	50%	36%	35%	56%	57%
5	**Computer at Home for Personal Use**	Y	74%	73%	67%	90%	72%	64%
		N	24%	27%	25%	10%	28%	36%
6	**Years Using Computers in Teaching**	<2	18%	27%	8%	25%	22%	0%
		3-5	46%	41%	75%	40%	34%	61%
		6-9	22%	23%	0%	30%	22%	31%
		10-13	9%	9%	17%	5%	17%	0%
		14 +	0%	0%	0%	0%	6%	8%
7	**I am self-taught (e.g. practice on the computer at home)**	Y	58%	45%	67%	65%	67%	50%
		N	42%	55%	33%	35%	33%	50%
8	**I received training from classes, conferences, and workshops on my own time.**	Y	87%	86%	92%	80%	94%	86%
		N	12%	24%	8%	15%	6%	14%
TOTAL NUMBER OF RESPONSES TO EACH QUESTION			87	22	12	20	18	14

*Percentages which do not equal 100% are the result of rounding or missing data

three. Paired t-tests were employed for these analyses; the criteria for selection was $p < .05$. Finally, a multiple regression was employed to determine predictors of teacher perceptions of their computer ability, attitudes and beliefs, instructional behavior, and work behavior. These predictor variables enabled administrators and teachers to focus their efforts to continue to improve the implementation of the Initiative.

Findings

The findings are framed by the research questions: (a) capacity to integrate computers into instruction, (b) teacher attitudes and beliefs, (c) teacher instructional behaviors, and (d) teacher work behaviors.

Teacher Capacity

The capacity concept was used first to identify teacher knowledge and skill levels relative to using computers in their classrooms by asking them to identify their ability level prior to the Initiative. They were then asked to make the same assessment at the end of years two and three of the Initiative.

The results of this assessment, displayed in Table 2, indicate that the Initiative had a dramatic impact on teacher ability to integrate computers into instruction. For example, non-technology using teachers were eliminated after the first year of the Initiative.

Table 2:
Teacher Perceptions of their Computer Ability Before and After the Computer Initiative by Grade Level

	Total				Grade Level																			
					1				2				3				4				5			
Ability Level	Y0	Y1	Y2	Y3	Y0	Y1	Y2	Y3	Y0	Y1	Y2	Y3	Y0	Y1	Y2	Y3	Y0	Y1	Y2	Y3	Y0	Y1	Y2	Y3
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Non-User	67	6	0	0	88	6	0	0	80	13	0	0	76	5	0	0	95	0	0	0	100	10	0	0
Novice	11	23	0	1	13	16	0	5	13	13	0	0	19	19	0	0	6	32	0	0	0	50	0	0
Beginner	1	56	38	24	0	59	42	18	0	33	46	16	5	76	44	45	0	63	20	17	0	20	43	14
Advanced	0	11	44	48	0	9	42	55	0	40	23	18	0	0	44	45	0	5	65	50	0	10	36	64
Accomplished	1	4	18	27	0	9	15	23	7	0	31	64	0	0	11	10	0	0	15	33	0	10	21	21
# Respondent	98	98	83	85	32	32	26	22	15	15	13	11	21	21	9	20	19	19	29	18	11	10	14	14

Note: Not all item responses will equal 100% due to rounding and/or response errors.

Legend : **Novices**– can perform only simple tasks on the computer with some difficulty. **Beginners** - can perform basic computer tasks (e.g. word processing) quite well, although they might not know or utilize the full potential of the program. **Advanced** - can perform numerous tasks on the computer (e.g. word-processing, graphics, information management etc.) quite well and is familiar with the software=s capabilities. **Accomplished** - know a great deal about computer software and hardware, and can perform many tasks using a variety of software.

Fifty-six percent (56%) of year one teachers reported that they were Beginners (i.e., they can perform basic computer tasks such as word processing quite well, although they do not know or utilize the full potential of the program). This percentage declined to twenty-four percent (24%) by year three.

Eleven percent (11%) of year one teachers reported that they were Advanced computer users (i.e., they can perform numerous tasks on the computer such as word-processing, graphics, and information management quite well and are familiar with the software's capabilities). This percentage increased to forty-eight (48%) in year three.

One percent (1%) of year one teachers reported that they were Accomplished computer

users (they know a great deal about computer software and hardware and can perform many tasks using a variety of software). This total increased to twenty-seven (27%) of the respondents in the third year of the Initiative.

Over a relatively short time, previous computer and teaching experience was equalized and no longer is a determining factor in predicting a teacher's ability to use computers in the classroom. For example, by the end of the third year, seventy-seven (77%) of the elementary teaching force were capable of infusing technology into their instruction as opposed to twelve (12%) of the teaching force before the project began. However, while teacher knowledge of the instructional side of the Initiative greatly improved each year, their knowledge of the technical side of the Initiative was still relatively weak by comparison.

Two factors identified from the focus group interviews indicate that these changes in teacher capacity are attributable to the school district's provision of training opportunities, and the extraordinary teacher effort to gain the skills necessary to implement the Initiative. For example, one teacher said, "I checked the computer out to get more comfortable with it, even on weekends." The impression this teacher gave was that she would get the computer and just spend the whole weekend, as well as weekdays when necessary, to plan, learn about the computer, familiarize herself, and make herself extremely comfortable with it. This particular teacher also seemed to be the type of person that if something went wrong, she would do something to try to fix it.

Another teacher said, "I can't emphasize enough the amount of time it takes to plan to integrate the computers into instruction." This teacher related that amount of planning required to get 5 stations focusing on one concept, but different aspects altogether, and have her students rotate through those stations took an enormous amount of preplanning on her part. Planning time, particularly as it relates to creating lessons which use computers, is the most difficult barrier to implementing the Initiative.

On the other hand, teachers believe that continued growth in developing their capacity to implement the Initiative may be hindered by the speed of the implementation, and the other mandated initiatives such as the State Standards of Learning (SOLs) which they are also expected to implement. Simply they felt overloaded by the requirements to implement computers into their instruction and the complexities created by this instructional tool. A sampling of focus group responses support these notions.

A Technology Instructor explained it this way: I get the sense that some of these people who may not be doing this [implementing the Initiative] may be experiencing some sort of overload. It's scary. Very overwhelming. A lot of things are really weighing on people. But, like I told one teacher who was still having a hard time with the Initiative and didn't like it, "You know, I would like to say something to support you, but if you don't like it you need to go work somewhere else because it isn't going away." I told her, "I hate to be that blunt with you, but that's the way it is. You're just going to have to learn to do this. This is part of your job. You have lots of opportunities to figure this out. I will help you in any way I can to make it easier. but you've just got to do this."

Another Technology Instructor supported the overload notion: "We've all talked about this over and over again. Yes there's an overload, but I think that overload is just as big on the teacher that's doing a dynamic job as it is on a teacher who always has an overload. These people are right on the fence of just getting it but need some more help. They need to have someone there, in a timely manner, to say, "All right, this is what we're going to do this week. This is what we're going to do next week. And this is what we are going to do the next week."

As a Teacher said, "At this point, we're always chasing the ball... They're trying to do too much too fast and ... for some schools, they're still having difficulty getting Netscape to work in the classrooms. It works on the library computers, but.... Well, you're expanding before you really have control of what you've got. Everybody is expected to be doing everything right away. Big time! And sometimes it's better if you sit down one on one with a child and open a book and teach him how to read."

Another Teacher said, "With these computers you're starting about 20 zillion new projects than you used to and...it makes you crazy sometimes. That's been really, really hard for me. When I go crazy, I just say "we're going to shut these down for a while, and we're just not going to get on them this afternoon."

Teacher written comments on surveys also support the overload notion and the complexity of integrating computers into their instruction. For example, "The pace is very frustrating to me... I do not feel comfortable with the fast and furious pace (17 respondents)." "With all we are expected to teach first graders -- the computer expectations are too high (13 respondents)." "I have no time to review , learn to use, or implement new software during the day. This has become a life consuming occupation (14 respondents)." "Sometimes less is more in the long run (12 respondents)."

On the other hand, the capacity of teachers to integrate computers into their instructional behaviors can be predicted from the teacher background variables. For example, in year three, 11.6% of the variance in teacher reported computer ability was accounted for by two items: item 2 (ethnicity) and item 5 (having a computer at home for professional use). These predictor variables have changed each year since the Initiative was implemented. For example, in year two, item 4 (years teaching), item 1 (gender), and item 6 (number of years using computers in instruction) accounted for 14% of the variance. In year one, 33.5% of the variance of computer ability was accounted for by item 4 (number of years teaching), item 6 (number of years computer used in teaching), and item 5 (computer at home for professional use).

Teacher Attitudes and Beliefs

As demonstrated, one reason for the dramatic increase in teacher knowledge can be attributed to teacher efforts to pursue the necessary knowledge. A second reason can be attributed to positive beliefs and attitudes as to the worth of the Initiative. Therefore, the concept of teacher attitudes regarding their ability to integrate computers into their instruction and the utility of computers in instruction were examined during each of the three years of the study. Table 3 displays the significant changes in teacher attitudes and beliefs over the 3-year period.

[Table 3 about here]

Table 3:
Teacher Attitudes that Significantly Changed Over the Three-Year Period

Item Year 1	Item Year 2	Item Year 3	Question	% Year 1	% Year 2	% Year 3
68 ****	67	69	The computer initiative has increased my interest in and knowledge about technology. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=22 A=58 D=12 SD=7	SA=65 A=35 D=2 SD=0	SA=66 A=31 D=3 SD=0
100 ****	103	102	A CURRENT barrier to most effectively using the initiative's classroom computers is that my knowledge of computers is still too seek to use them effectively. MD=Most Difficult; MMD=More than Moderately Difficult; MoD=Moderately Difficult; LMD=Less than Moderately Difficult; LD=Least Difficult	MD=8 MMD=47 MoD=39 LMD=5 LD=0	MD=2 MMD=6 MoD=13 LMD=22 LD=57	MD=1 MMD=4 MoD=18 LMD=29 LD=4
104 ****	107	106	A CURRENT barrier to most effectively using the initiative's classroom computers is that I don't understand the technical side of the initiative. MD=Most Difficult; MMD=More than Moderately Difficult; MoD=Moderately Difficult; LMD=Less than Moderately Difficult; LD=Least Difficult	MD=4 MMD=40 MoD=51 LMD=4 LD=0	MD=10 MMD=17 MoD=25 LMD=28 LD=21	MD=26 MMD=14 MoD=11 LMD=20 LD=29
67 ****	66	68	I enjoy working with my students on the computer. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=28 A=59 D=13 SD=0	SA=57 A=39 D=2 SD=2	SA=57 A=41 D=2 SD=0

Note: Not all item responses will equal 100% due to rounding and/or response errors
Paired t-tests were employed for these analyses. Items presented in the table demonstrated significant changes at $p<.05$.
*Statistically significant difference between year one and year two findings
**Statistically significant difference between year two and year three findings
***Statistically significant difference between year one and year three findings
****Statistically significant difference found each year

Finally, the researchers assumed that positive teacher attitudes toward computers, and their integration into instruction, is a necessary precondition to positive changes in teacher classroom and work behavior which eventually impacts student motivation to learn and perform. Therefore, they felt that if school administrators and staff developers understand those critical factors which predict positive attitudes toward integrating computers into instruction, they would be able to create strategies to support the development of positive attitudes and beliefs toward the teachers use of computers in their instructional strategies.

An attitudinal profile critical to the successful instructional uses of computers was developed and a multiple regression was conducted to gain an understanding of those factors which predict positive teacher attitudes. The critical factors were identified by analyzing where teachers strongly agreed with the following six ATTITUDINAL items which relate to using computers in instruction: (a) enjoyment of working with students on computers, (b) importance of the initiative to their work; and feelings of accomplishment, (c) increased knowledge and interest, (d) getting the most out of the computers, (e) satisfaction with their progress, and (f) the belief that the initiative was worth the cost and time. These items comprise the attitudinal profile found in Table 4 which is viewed as CRITICAL to the successful instructional use of computers provided by the Initiative.

[Table 4 about here]

First, an ideal score was created for Teacher Attitude by assuming that each time a teacher strongly agreed with the six critical attitudinal questions they possessed an Ideal Attitude to integrate computers into their instruction and to implement the Computer Initiative. The further their score was from the IDEAL the less positive attitudes they possessed toward integration and implementation. Then a multiple regression was employed to determine which items on the survey predicted the critical TEACHER ATTITUDE profile. The results of these analyses are found in Table 4.

Table 4:
The Critical Factors used to Identify the composite Teacher Attitude Profile and Items which Predict the Ideal Teacher Attitude

Teacher Attitude	Survey Items Selected	
Profile (Composite) Ideal Score = 6	Q68 I enjoy working with my students on the computer. Q69 The Computer Initiative has increased my interest in and knowledge about technology. Q70 I consider the Computer Initiative as being very important to my work as a classroom teacher. Q71 I feel that my school is getting the most out of the computers in the classrooms. Q72 I feel that the computer initiative is worth the cost and time. Q73 I am satisfied with the progress I have made since the beginning of the Computer Initiative.	
Critical Factors (Items that predict the profile)	**Year 2 Results** 82% of the variance explained by: Q16 The Computer Initiative has motivated me to grow professionally as a teacher. Q82 I feel I have adequate support from administration Q71 I am satisfied with the progress I have made since the beginning of Computer Initiative. Q8 The grade level taught by the teacher. Q31 How the teacher uses computers in class. (I.e., Text processing, instructional software, analytical program, games, variety of software.) Q83 My perception is that parents are supportive of computers in the classroom. Q58 Trying out new techniques in instruction is needed for optimizing student learning. Q53 I spend less time with the whole class practicing or reviewing material. Q88 Student attention has improved since the introduction of the Computer Initiative.	**Year 3 Results** 80% of the variance explained by: Q80 As I plan for the subject matter to be presented in a lesson, I also plan how tech can be used to implement the unit. Q90 My average achieving students have profited from initiative. Q67 I have good support from the administration. Q78 The computers have allowed me to better produce products such as newsletters. Q112 Enough planning time. Q40 Use the computer for understanding science. Q93 Students have improved their research skills. Q98 Students have improved in their ability to work cooperatively with other students since the computer initiative was introduced.

Note. Strong agreement with each statement is assumed to represent positive movement toward initiative success. Ideal scores for teacher attitude is 6. For example, if a teacher were to answer items 68-73 with ?strongly agree,? that teacher would have a critical factor score (CFS) of 6 points, a point for each instance of strong agreement. The difference between the CFS and the ideal critical factor score (ICFS) for teacher attitude (i.e., 6) would be 0 or a perfect match with the ICFS and more conducive to computer integration when compared to their counterparts with larger CFSs.
Note. A multiple regression was employed for these analysis. The criteria for selection was $p<.05$. The above items account for 80% of the variance in the teacher behavior CFSs in this sample. Survey items used to develop the teacher attitude profile were excluded from this analysis. General, items included in the equation earlier account for more variance initially. The model/profile is completed when the additional of further items DO NOT account for any more significant amount of variance or predictability in the critical factor scores for teacher attitude.

As seen on Table 4, administrative support is a strong predictor of positive attitudes.

Therefore, an effort to train principals and school based personnel in how to provide

adequate planning time and observe, coach and reward teachers in the integration of computers into their instructional strategies would support increases in positive teacher attitudes and beliefs.

Table 4 also displays that predictors of the critical teacher attitude profile change as they gain more knowledge and their capacity to integrate computers increases. For example, in year three, items related to teacher behaviors related to planning for the integration of technology as they develop their lesson plans are more important than the motivational effects of having computers in their classrooms. Therefore, it is important to recognize the long term importance of staff development in increasing teacher capacity to integrate technology is cumulative and takes time to develop. However, when it does develop it is powerful in the mindful use of computers in their instruction.

Finally, the third predictor of the teacher attitude profile is the ability of the computers to improve student behavior and learning. For instance, teachers' attitudes are impacted by increases in student attention and their ability to work cooperatively. By the third year, their perceptions that student skills and learning is increasing was a prime predictor of their attitudes and behaviors. Again, the long term impact of appropriate staff development gives teachers the capacity and support to integrate computers into their instruction. Therefore, school administrators should pursue strategies which provide knowledge in both the management of the classroom and the integration of technology.

Teacher Behaviors

Teacher behaviors were sampled by dividing them into instructional and work behaviors. Instructional behaviors were studied by using the concepts of the (a) instructional goals, (b) curricular objectives, (c) instructional strategies, planning behaviors to integrate computers into their instruction, and (d) classroom organizational behaviors.

Teacher work behaviors were studied by using the concepts of (a) collegial consultation and planning for the use of technology in their instruction, (b) the impact of the computer on their management of student information and grades, and (c) their use of the computers to improve their own products such as bulletin boards and newsletters.

Teacher Instructional Behaviors. Teacher behaviors in preparing, delivering and assessing their classroom instruction were the first set of behaviors examined.

Instructional Goals. Teachers were asked to respond to the instructional reasons they used computers in their classrooms. First, they were asked if they used computers in their classroom to: (a) introduce new concepts by preparing students for instruction on a topic by using an appropriate software package, (b) reinforce the core curriculum by providing students with extra practice on material already learned, (c) extend the core curriculum by providing additional information on a topic, and/or (d) remediate the core

curriculum by providing appropriate software for students who need additional help on a topic

As seen in Table 5, teachers report that reinforcing and extending the core curriculum is a MORE IMPORTANT use of computers in their classrooms than remediating the core curriculum and using computers to introduce new concepts in year two. However, a dramatic change occurred in teacher instructional behavior by year three when significantly more teachers are using the computers to reinforce the core curriculum by providing students with extra practice on material already learned as opposed to extending the core curriculum by providing additional information on a topic. This change may be attributed to other priorities in the school district which focused teacher attention on increasing student performance on state mandated standards of learning. Additionally, in-depth analysis by grade level indicated that instructional purposes are also influenced by teacher grade level. For example, teachers in grades two, three, four, and five place more emphasis on reinforcing the core curriculum which is a less important goal for teachers in grade one.

[Table 5 about here]

Table 5:
Significant Changes in Teachers' Perceptions of Instructional Goals for the Use of Computers in Their Classrooms from Year One to Year Three of the Computer Initiative

Item Year 1	Item Year 2	Item Year 3	Question	% Year 1	% Year 2	% Year 3
34 ****	28	30	I use the computers in the classroom to reinforce the core curriculum. MIG=Most Important Goal; PG=Primary Goal; MG=Moderate Goal; LIG=Least Important Goal	MIG=3 PG=31 MG=43 LIG=23	MIG=37 PG=39 MG=24 LIG=0	MIG=41 PG=46 MG=13 LIG=0
35 ****	29	31	My goal for using the computers in the classroom is to extend the core curriculum. MIG=Most Important Goal; PG=Primary Goal; MG=Moderate Goal; LIG=Least Important Goal	MIG=56 PG=39 MG=9 LIG=0	MIG=45 PG=45 MG=9 LIG=1	MIG=8 PG=11 MG=42 LIG=38
36 ****	30	32	I use the computer in the classroom to remediate core curriculum. MIG=Most Important Goal; PG=Primary Goal; MG=Moderate Goal; LIG=Least Important Goal	MIG=41 PG=52 MG=7 LIG=0	MIG=12 PG=27 MG=29 LIG=33	MIG=9 PG=28 MG=37 LIG=26

Note: Not all item responses will equal 100% due to rounding and/or response errors
Paired t-tests were employed for these analyses. Items presented in the table demonstrated significant changes at $p<.05$.
*Statistically significant difference between year one and year two findings
**Statistically significant difference between year two and year three findings
***Statistically significant difference between year one and year three findings
****Statistically significant difference found each year

Curricular Objectives. Curricular objective refers to the teachers' curricular intent when using computers in their classrooms. To judge teacher intent, they were asked to rank the priority they placed on six areas (language arts skills, writing, reading, math skills and math application, social studies and science) in instruction.

When comparing three years of data it was apparent that teachers primarily used the computer to improve language arts, reading, and writing skills. All other curricular areas while moderate objectives, decreased in emphasis over the time period. For example, as Table 6 indicates, in the third year of implementation the primary curricular objective of teachers was improvement of language arts, math, social studies, or

science. For example, fifty-eight (58%) of the year three teachers strongly agreed that improving language arts skills was their primary goal for using computers in the classroom as compared to twenty-eight (28%) in the first year of the Initiative. In this curricular area by the third year, seventy-four (74%) indicated that their primary objective was to use computers to improve writing skills and fifty-two (52%) reported using classroom computers to improve reading skills. These third year findings in language arts are just slightly higher than teacher responses at the end of year two on the same items but significantly different from teachers reporting at the end of year one.

[Table 6 about here]

Mathematics skills and application were moderate curricular objectives of the respondents with emphasis significantly increasing by year three. Science emphasis also significantly increased by year three but remained subdued when compared to language arts. Social studies was another matter as there was a significant decrease in emphasis in using the computers. For example, in year one eighty-five (85%) of the respondents strongly agreed that understanding social studies was an objective for the use of the computers as opposed to fourteen (14%) in year three.

Table 6:
Significant Changes in Teachers' Perceptions of Curricular Objectives for using Computers in Their Classrooms from Year One to Year Three of the Computer Initiative

Item Year 1	Item Year 2	Item Year 3	Question	% Year	% Year 2	% Year 3
39 ****	34	36	Improving language arts skills is an objective for using the computer in the classroom. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=28 A=46 D=21 SD=5	SA=55 A=41 D=2 SD=1	SA=58 A=38 D=5 SD=0
41 ****	36	38	Improving writing skills is an objective for using the computer in the classroom. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=39 A=43 D=16 SD=2	SA=68 A=32 D=0 SD=0	SA=74 A=24 D=2 SD=0
37 ****	32	34	Mastering math skills is an objective for using the conputer in the classroom. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=10 A=24 D=66 SD=0	SA=27 A=57 D=11 SD=6	SA=26 A=54 D=18 SD=2
38 ***	33	35	Learning to apply math is an objective for using the computer in the classroom. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=28 A=45 D=22 SD=5	SA=30 A=57 D=11 SD=2	SA=37 A=57 D=7 SD=0
43 ****	38	40	Understanding science is an objective for using the conputer in the classroom. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=8 A=36 D=42 SD=14	SA=13 A=55 D=27 SD=4 DK=1	SA=17 A=54 D=27 SD=1
42 ****	37	39	Understanding social studies is an objective for using the computer in the classroom. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=85 A=11 D=2 SD=2	SA=15 A=48 D=31 SD=7	SA=14 A=58 D=25 SD=2

Note: Not all item responses will equal 100% due to rounding and/or response errors
Paired t-tests were employed for these analyses. Items presented in the table demonstrated significant changes at $p<.05$.
*Statistically significant difference between year one and year two findings
**Statistically significant difference between year two and year three findings
***Statistically significant difference between year one and year three findings
****Statistically significant difference found each year

A comparison of these curricular objectives by grade levels revealed that while language arts was the primary overall objective in primary grades, other curricular areas gain priority in the upper grades. For example, the level of computer use to improve reading was strong at all grade levels. However, teachers in the primary grades place a greater priority for its use than teachers in the upper grades.

Additionally, the level of computer use to improve writing was consistently strong across all grades except fifth. However, its priority was greater in the primary grades. For instance, eighty-six (86%) of the teachers in grade one, ninety-one (91%) of teachers in grade two and eighty (80%) in grade three primarily use computers to improve writing skills. Additionally, the level of computer use to improve math is moderately strong at all grade levels. However, it too was a more of priority at grade one and two than the upper grades.

Instructional Strategies. Instructional strategies refer to the purpose and manner in which teachers use the computers and software provided by the initiative. In particular the analyses examines the way computers in classrooms have changed teacher classroom behavior. In examining several questions found on Table 7, it's easy to detect that teachers believe that the introduction of five computers into their classroom has caused them to change the way they think about and deliver the instructional program to students in four ways. Teachers are:

- Better able to present more complex material to their students;
- Use a more thematic approach to their instruction;
- Use less lecture and whole class instruction; and,
- Use more small group instructional strategies.

Table 7:
Classroom Behavior Survey Items to Which Teacher Responses Significantly Differed in Years One to Two and Years Two to Three

Yr 1 Item	Yr 2 Item	Yr 3 Item	Question	Year 1 %	Year 2 %	Year 3 %
57 **	52	54	I spend less time lecturing to the entire class (whole group instruction) SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree	SA=22% A =51% D =26% SD= 1%	SA=23% A =52% D =25% SD= 0%	SA=22% A =42% D =29% SD = 5%
58 ** ***	53	55	I spend less time with the whole class practicing or reviewing material SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree	SA=19% A =51% D =29% SD= 1%	SA=19% A =51% D =29% SD= 1%	SA=14% A =45% D =36% SD= 5%
60 *** *	55	57	I use a thematic approach across subject areas. SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree	SA=16% A =34% D =42% SD= 8%	SA=41% A =30% D =28% SD= 1%	SA=27% A =53% D =20% SD= 0%
77 *** *	79	81	The computer Initiative has changed my approach to classroom management and instruction. SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree	SA=55% A =41% D = 3% SD= 1%	SA=33% A =49% D =16% SD= 2%	SA=21% A =52% D =26% SD= 0%
60	54		Since I have been using computers I am better able to present more complex material to my students SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree	SA=16% A =34% D =42% SD= 8%	SA=28% A =42% D =29% SD= 1%	

Paired t-tests were employed for these analyses. Items presented demonstrated significant changes at $p<.05$

For example, twenty-eight (28%) of the teachers in 1997 strongly agree that they are more able to present more complex material to their students than teachers in 1996 sixteen (16%). When the strongly agree category was combined with the agree category, this change is apparent in greater numbers. Seventy percent (70%) of the teachers in 1997 agree or strongly agree that they are more able to present more complex material to their students than they were in 1996 (50%).

Other significant changes in teacher instructional strategies described in Table 7, include: (a) significantly more teachers in year three responded that they spend less time lecturing to the entire class than teachers did in year two; (b) significantly more teachers in year three spend time practicing or reviewing material with the whole class than teachers did in year two; and, (c) significantly fewer teachers strongly agreed in year three, than did in year two, that trying out new techniques in instruction is needed for optimizing student education.

The focus groups support the findings that are reported as occurring in the classroom exhibited on Table 7. For example,

- Teacher: "I think it individualizes more. So if you have a child that is a really strong reader you could put him on a computer and have him work at a higher level."
- Teacher: "A lot of the children had difficulty reading back what they wrote. I feel like it's getting better and better. A child can sort of go on his own basically."
- Teacher: "A child can make a lot of progress by just having the desire to try to go to that next level."
- Technology Instructor: "I think the teachers are finding that the whole group instruction is not the way to go if you expect to get the children at the computers every day. They're having to do "stations" more and work with small groups as opposed to standing up and lecturing all day long.

That's the biggest difference I've seen. It's also a real frustration to a lot of teachers who are reluctant to give up that... And I think you need some of both, but the ones who have been the most frustrated have been the ones reluctant to let go of the whole group style."

Integration Models. Integration refers to the extent to which teachers have incorporated computers into their instructional delivery. When integrating computers into teaching, teachers must make decisions about how the content and computers will be integrated, and how the integrated content and computers will be managed.

Three basic integration models were found through classroom observations. Teachers use a:

- Complete integration model (CIM). CIM is an instructional strategy where all students in a classroom are focused on a unitary theme (or aspects of a theme). The class is completely immersed into the same topic or aspects of the same topic. All students work on the same topic or aspects of the same topic during the same time period. Classroom and computer activities are integrated and reinforce one another. The complete integration model intuitively suggests less strain on the teacher since there is essentially one topic being focused on.
- Semi-integration model (SIM). SIM is an instructional strategy where students are not focused on a single topic or theme. The classroom and computer activities are obviously distinct and different and do not reinforce one another.
- Mixed Model (MM). MM is a mixture of complete and semi-integration strategies.

Teacher focus group comments fleshed out the researcher observations:

- Teacher: "Learning stations in a classroom can focus in on entirely different topics. Some focused on several different subject areas, others are, for example, you know, it's now math time and there are four stations that all have to do with math and we're doing some kind of measurement at each station. . . . with what we were working on Tuesday, all those different stations dealt with the Arctic regions, creating an art project, or research using a electronic data base."
- Teacher: "Let me clarify exactly, a station can be, for example, let's say the computers are on that wall. This could be a station doing one thing, the other computer is a station doing another thing. The computer is just a station doing one aspect. For example, if we were all focusing on math, that's focusing on one aspect of math. . ."
- Teacher: "I do the topic of the day such as math. All stations would have different concepts of math and ideas concerning math. Each station was simply focusing on one particular topic.

That's all it is."

The integration approach used by teachers depends on the teachers beliefs about the role of the computer in instruction, and the instructional objectives they attempt to meet through integration. Once these decisions are made, teachers must decide how long students will be allowed to use the computers at one time, how often they use the computers in a day or week, and how they move students in and out of computer time. Student movement or rotation through the different centers is dictated by how teachers choose to distribute computer time. Teachers who manage the integration of computers through the learning stations strategy must decide (a) the number of students using computers, (b) how long they use them, (c) how often they use them, and (d) the manner and methods teachers use to move students in and out of computer time.

The complete and semi-integration models are usually delivered through learning stations (sometimes referred to as Center). Learning stations describe a method of instruction in which teachers set up computer centers in the class covering either a variety of topics, or aspects of one topic, depending on the instructional model being employed. The strategy, however, is used by more teachers in grade one and two where fifty-eight (58%) and sixty-two (62%) of the teachers, respectively, strongly agree that they use learning stations in their instruction. The use of this strategy decreases in intensity through the upper elementary grades.

Stations are places where learning activities are set-up. The activities at the stations may be assigned by teachers to students through a: (a) structured timed rotational approach, (b) a structured task rotational approach, or as an (c) unstructured reward approach where students work on editing products at teacher direction. The timed rotational approach fits nicely with the complete integration model where everyone is focusing on math and different aspects of mathematical concepts. According to the teachers observed, this approach requires a lot of planning time. In the other two approaches where students are working on teacher tasks or student tasks and most of the class is doing something else. Observations and focus group interviews produced insights into how teachers use these strategies to move students into and out of computer use.

Time Directed Rotational Approach. Some teachers establish stations and rotate students through them on a timed rotation. Time directed rotation refers to teachers allocating specific amounts of computer time to students for specific tasks. The key factor involved in rotating students in and out of computer use is time. In this rotation model there are 4-5 or 6 students to each computer. Movement is time directed and there is a time limit placed on every activity. To complete timed rotations takes about a 2-hour block of time. Some teachers say they don't use this approach because they can't squeeze it into the block of time available to them. The timed rotational approach seems to occur more at the primary level than in the upper elementary levels.

- Teacher: "I find that I am using rotations a lot more this year. I'm doing a lot more rotation because I definitely like the control of everybody paying attention to me at the same time --you know, I'm going to give you your directions and then we'll do this."

- Teacher: "I do rotations on Tuesdays and Thursdays and then more of a whole class approach on Mondays, Wednesdays and Fridays. Not every day. It's during the week periodically whenever it fits in to what I've planned."

- Teacher: "Once a day, but again, I work on a grade level and we all are coming up with things and I'm not the only one generating something to do on the computer."

- Teacher: "I spend a certain amount of time on it then move on." "Some teachers will do it three days a week, then four days a week, now every week, using the rotations. I think some teacher want to have it very structured where a group physically moves from one station to another in a timed manner."

Task Directed Rotational Approach. Other teachers establish stations and rotate students through by a task completion rotation. Task directed rotation refers to teachers establishing tasks to be accomplished and students move in and out of the computer area based on the completion of tasks. In this station model, students use computers either individually or in pairs and work on a list of tasks.

- Teacher: "....and then 5 maybe are doing research over in the corner with an encyclopedia and 5 are on the computers and 5 are doing...

- Technology Instructor: "Others will say, alright, here's what you have to do for the whole entire day, if somebody is not at that station, go and do it, if they are, that's fine. They have a contract and a lot of first and second grades do that."

- Teacher: "I've been much more relaxed about stations and we're still going to get to the same amount of things, we just may not all get to it at the same time. That's been a difficult part for me because I like closure. I like counting those papers, knowing I've got everybody's. And everybody's done. That's been really , really hard for me --to finish up projects."

- Teacher: "You can rotate...at your own speed. OK I'm done with this--I'll go to this now."

- Teacher: "When you finish the task move on if the next station is now available, move into it."

- Technology Instructor: "I have some people that have a station that runs all week. You know, here's what you have to do by the end of the week in the station. I think of one that's a spelling station. I don't need to schedule for the whole class to write their spelling words five times together."

- Observer: "The priority basically was, did a student or group of students have some additional work that needed to be done on a particular project. So, if someone else was on the computer and this person needed to finish an assignment or whatever, that person would have priority. So

if the one on the computer already was just doing something for free time or what have you, that person would be bumped to make sure that the other person could complete his project."

Teacher Directed Random Approach. The teacher directed approach refers to allocating computer time as a reward, remediation and/or research. Teacher direction occurs when the teacher makes decisions as to who uses the computer and when. Students can, however, also use computers in the library for research.

> Observer: "From what she was saying...a few of the teachers...it is really hard to grasp at times what-because I think in their own minds they aren't totally sure about they were doing--so some of the times it seemed they were winging it. This is the same teacher who does make her own selections at times as to what person is going to do this. So it's not like a set rule of who's going to be using the computer. I felt she was using it as a reward-type thing (use of the computer)."

Number of Students. Focus group interviews indicated that teachers prefer four students to a computer when using stations. However, while they can "live" with five students to a computer, they feel that six students become unmanageable and cooperation among students become burdensome.

- Teacher: "The initiative distributed the computers equitably, five computers to a classroom. But should we consider the fact that if there are 30 kids in there, they ought to have 6 and the other one with 15 ought to have 4."

- Teacher: " I think 4 is a good number. I think the hard thing--with the group I have this year, if they don't all get to every activity, they can see because they're all in the room together so it's like they know what every station is and it's like you can't explain it on Tuesday and then say, but you can't do it until Thursday... that just sends them to the edge. So 4 is what I want, 5 is OK and 6 is no."

- Teacher: On some days when I go to 5 stations because of the activities I've chosen, I end up with some with 6 kids in them, and I have to send 1 or 2 children out to another classroom for their 20-minute rotation, well then I'm not with them and that becomes the problem because they may have questions and they have to come back into my room or they have to ask the other teacher. We've got kids coming in and out all the time trying to utilize the computers we have."

- Teacher: "With the new library initiative this year, I've been able to use the flex scheduling which I know is a taboo word, but if there are a lot of kids in there, I can send a group of 5 up to the library either to research or to just read silently or there have been times, you know they have different computers in the library than we do in our classrooms, so in advance I will go up and make up something to go with a CD-Rom that can be used on the library station and I can cross my fingers and send those 5 kids up with a direction sheet to follow along on the CD-ROM up there. So that helps get 5 kids out of your room but still they are doing something constructive. Unless they misbehave and get sent back to my room or the library is closed for

whatever reason, that's another station you've got to spend your time making up instructions."

Amount of Computer Time. Focus group interviews indicate that most of teachers found time to get students on the computer at least every day. Teachers become evasive when asked the exact amount of time. Some teachers who seem to have the most difficulty adjusting to it seem to say "well, I can't do that all the time." But the teacher who excels, has no problem getting her students to use those computers every day. When pressed for answers teachers give general ballpark figures of 15-25 minutes a day, about 1-2 hours a week.

- Teacher: "Probably on average an hour a week. I'd probably say an hour [15-20 minutes a day]."
- "Probably on average an hour a week."
- Teacher: "I would say 2 hours a week."
- Teacher: "I don't have a clue really. About 2 days a week -- 20-25 minutes so roughly 50 minutes and then we have another rotation for probably half an hour so I mean that's...about 2-1/2 to 3 hours each week. That's probably a good ballpark."

Focus group interviews also indicate that the amount of time each student gets on the computer is also dependent on several factors such as: a computer lab in the school.

- Teacher: "I would say because we have the lab, our students are probably 2-3 hours a week."
- Teacher: "Every school should have a lab. That's really such a great resource and we have that a block every week for 40 minutes and it's so great because you can go in there and do an entire whole class lesson with them and they can all be using the software or whatever--a math lesson or a writing lesson...without trying to put 27 kids around one terminal while you're sitting there typing. That frustrates them and frustrates me but the other option is you know, not to use the software and not to use the programs and we don't want to do that..."

Length of time also depends on the type of student using the computer. The reports varied from: "unlimited" to "fifteen minutes."

- Teacher: "It depends on the child." "Yes." "Right." "I think I stretched it to 30 right now." Are you talking about one station before you even change? "Yeah."

- Interviewer: How long should an activity be? Teacher: "20 minutes. I found about 22-23 minutes is like the max time limit for my kids. We started at 30 and it was like by the end they were--we worked it down and 22 minutes works for me. It seems to be just enough time for them to either get it done or almost done to the point where they're still excited and then sometimes we take an additional 5-10 minute rotate to finish up."

- Teacher: "I would say probably as long as 30-40 minutes, as long as they have their own computer. When we're sharing the World Book Encyclopedia, that's when I find that they...because they're working with each other...that they either get tired of working with each other or they tend to play. It's easier to get off-task with a group and play. Well, I think the children who are on the computer stay more focused than the others... "

- Teacher: "If they're at their own individual computer. They stay longer at the computer. They hate to leave the computer. They could stay all day long and work on the computer. I've never had a student say can we change to another station when they were on the computer."

- Teacher: "Between 20-30 minutes. Now this is a station where there are 5 students at one computer? Or are you talking about one student at a computer? One student per computer."

- Teacher: "I might have four rotations, but for today I'm just going to do two. Younger children can't do it, they don't need 45 minutes, they need 20 minutes.

- Teacher: "You use the computers with un-focused students slowly. If there's a definite activity they know they need to do on the computer and it might take several days for the whole class to get to it, but they all know what their activity is or assignments are on the computer. This group really needs very close structure, supervision...that it's real difficult to have a group over here doing something, and it needs to be much more managed than a free flowing situation. I think that's true every time. Every year. You're going to have to reevaluate..."

Finding the time.

- "For me, with having to do 6 rotations which I do, if you do it at 20 minutes plus explaining each activity prior to them getting started so they are not running over to you asking questions, that's roughly like a 2-1/2 hour block by the time you establish the group, explain all the activities, get them in their rotations and give them a minute or two to rotate between the two and get settled again. Like she said, finding a 2-1/2 hour block in your day is awfully hard."

One researcher summarized his observations as follows:

> Rules and regulations for the classroom, including the computer, are often posted in some manner: on the board and/or the computer monitor. Actual rotations during learning stations may occur during one part of the day (i.e., the morning). In the afternoon more whole group instruction is employed and computers are used when there is appropriate software for the topic.
>
> The lower grades appear to use learning stations more than the higher

grades. Students go to the computer individually or in groups (for some classes group membership varies). The time of computer use is not set (some teachers are more aware than others on this issue). Sometimes students remained on the computer five minutes and others thirty minutes.

Most classes are very active during the morning hours, with students moving about the class, teachers making rounds to stations or students to answer specific question or to test student's knowledge. Students for the most part seem to know the routine, and if they are unsure, the teacher and/or a student will guide them.

Teachers seem to use either a priority/task activated method (has the student finished an assignment) to move students into or out of computer use or a teacher activated method (based on time or another factor for example a reward). There appeared to be a tendency toward a priority activation model--which may provide teachers with greater flexibility. There was an observed difference in the degree of positive feedback given to students by their teachers.

The students are very independent, they are very focused. If you walk by the room, it does not seem that they are very focused because it does not look like a traditional room. It's not quiet. It's very interactive. The teacher may be doing one of several things: working with a small group with the rest of the class working in groups, they may be circling around, and that's a good way to start it for some teachers. . . Kind of floating and checking on different things. . .

Teacher Work Behavior. Teacher work behavior refers to collegial consultation and planning for the use of technology in their instruction, the impact of the computer on their management of student information and grades, and their use of the computers to improve their own products such as bulletin boards and newsletters. The concept of work behaviors was used to identify changes in how teachers related to one another, planned, and assessed their work.

First, table 8 shows that there was a strong agreement among teachers that the computers allowed them to create better products such as newsletters. For example, ninety-eight (98%) of the teachers strongly agreed or agreed with the statement.

[Table 8 about here]

Mathematics skills and application were moderate curricular objectives of the respondents with emphasis significantly increasing by year three. Science emphasis also significantly increased by year three but remained subdued when compared to language arts. Social studies was another matter as there was a significant decrease in emphasis in using the computers. For example, in year one eighty-five (85%) of the respondents strongly agreed that understanding social studies was an objective for the use of the computers as opposed to fourteen (14%) in year three.

Table 8:
Teacher Work Behavior Survey Items on Which Teacher Responses Significantly Differed from Year One to Year Three

Item Year 1	Item Year 2	Item Year 3	Question	% Year 1	% Year 2	% Year 3
N/A **	81	83	I use the school district Resource Guide for lesson plan ideas. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	N/A	SA=15 S=54 D=20 SD=11	SA=28 S=58 D=13 SD=1
72 *** *	73	75	I discuss technology, ideas, and resources with other teachers. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=28 S=59 D=13 SD=0	SA=39 S=58 D=4 SD=0	SA=35 S=61 D=4 SD=0
75 *** *	77	79	The Computer Initiative has encouraged me to plan cooperatively with other staff. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=37 S=45 D=16 SD=2	SA=27 S=40 D=34 SD=0	SA=17 S=51 D=31 SD=1
97 *	100	99	A CURRENT barrier to most effectively using the Initiative's classroom computers is that there is not enough time to develop lessons that use computers. MD=Most Difficult; MMD=More than Moderately Difficult; MoD=Moderately Difficult; LMD=Less than Moderately Difficult; LD=Least Difficult	MD=40 MMD=28 MoD=24 LMD=5 LD=3	MD=55 MMD=30 MoD=7 LMD=5 LD=2	MD=54 MMD=25 MoD=19 LMD=0 LD= 2
98 *** *	101	100	A CURRENT barrier to most effectively using the Initiative's classroom computers is that there is not enough help for supervising student computer use. MD=Most Difficult; MMD=More than Moderately Difficult; MoD=Moderately Difficult; LMD=Less than Moderately Difficult; LD=Least Difficult	MD=19 MMD=57 MoD=22 LMD=2 LD=0	MD=17 MMD=27 MoD=33 LMD=17 LD=7	MD=19 MMD=39 MoD=24 LMD=8 LD=10
74 ****	75	77	The computers have been helpful to me in managing student information. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=35 S=39 D=22 SD=2	SA=19 S=43 D=25 SD=11	SA=19 S=31 D=32 SD=8
73 *** *	74	76	The computers have been helpful to me in managing grades. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	SA=51 S=40 D=8 SD=1	SA=20 S=11 D=49 SD=21	SA=18 S=13 D=45 SD=17
N/A **	76	78	The computers have allowed me to produce better products such as newsletters. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree	N/A	SA=72 S=24 D=1 SD=2	SA=61 S=37 D=2 SD=0

Note: Not all item responses will equal 100% due to rounding and/or response errors
Paired t-tests were employed for these analyses. Items presented in the table demonstrated significant changes at $p<.05$.

*Statistically significant difference between year one and year two findings
**Statistically significant difference between year two and year three findings
***Statistically significant difference between year one and year three findings
****Statistically significant difference found each year

Second, teachers, significantly increased their discussion of technology ideas with other teachers from year one to year two. This increase was maintained at year three. It appears that as teachers gained more confidence in their capacity to integrate technology into their instruction the more willing they were to discuss it with their colleagues. While this phenomenon was found at all grade levels, teachers in the primary grades engaged in more cooperative planning with their colleagues than the teachers at the upper grades.

Third, while teachers were increasingly willing to discuss technology ideas with their colleagues, they were significantly less inclined to enter into joint planning. Thirty seven percent (37%) were more encouraged to do so in year one but only seventeen (17%) were so inclined in year three. This reduction could be caused by several factors such as strong feeling of loss of planning time. It should be noted that at the end of year one planning time was reduced by school administrators which may have constrained the ability of teachers to enter into joint planning efforts. It should also be noted that lack of planning time was the most significant barrier to implementing the Initiative perceived by teachers for each of the three years of the study. Or, teachers may have less need to cooperate due to improvement in skills.

Fourth, overall, teachers are less reliant on the District's Teacher Resource Guide for lesson plan ideas than each other. For instance, in the year three, seventy (70%) agree or strongly agreed that they use the resource guide for lesson plan ideas as

compared to eighty-six (86%) in the second year of the initiative. However in year three, there has been an increase in the number of teachers who strongly agree that they are using District's Resource Guide for lesson plan ideas (28% in year three as compared to 15% in year two). It appears as teachers gain in skills they conduct a more sophisticated search for information that will help them plan for their instruction.

Finally, the researchers assumed that positive teacher behaviors would lead to implementation of the Initiative and improved student motivation and performance. Their overall assumption was that positive teacher attitudes lead to positive teacher classroom behaviors which eventually positively impact student motivation and performance. Therefore, it is necessary for administrators and staff to identify and understand those factors which predict the critical instructional and work behaviors. With this understanding, they can focus their supportive efforts to improve teacher behaviors toward integrating computers into instruction.

The critical factors were identified by analyzing the data to identify where teachers strongly agreed with the five TEACHER BEHAVIOR PROFILE factors are found in Table 9. They relate to (a) preparing i.e., using the school district's Resource Guide, planning with other teachers, planning for computer integration when lesson planning; (b) using computers in instruction i.e., changing the way they manage their classroom and deliver instruction; (c) their beliefs i.e., enjoyment of working with students on computers, importance of the initiative to their work; (d) feelings of accomplishment i.e.,

increased knowledge and interest, getting the most out of the computers, and, (e) satisfaction with their progress, and the belief that as they become better at integration of computers their students will be better able to manage their own learning. These five factors were viewed as CRITICAL behaviors necessary to the successful instructional use of computers provided by the initiative.

An ideal score was created for Teacher Behavior Profile by assuming that each time a teacher strongly agreed with the five critical behavior questions they possessed the Ideal instructional behavior to integrate computers into their instruction and to implement the Initiative. The further their score was from the IDEAL the less positive instructional behaviors they possessed toward integration and implementation. Then, a multiple regression was employed to determine which items on the survey predicted the critical TEACHER BEHAVIOR PROFILE. The results of these analyses are found in Table 9.

[Table 9 about here]

Table 9:
The Critical Factors used to identify the composite Teacher Behavior Profile and Items which Predict the Ideal Teacher Behavior

Teacher Behavior	Survey Items Selected	
Profile (Composite) Ideal Score = 5	Q79: The Computer Initiative has encouraged me to plan cooperatively with other staff Q83: I use the school district's Teacher Resource Guide for lesson plan ideas Q80: As I plan for the subject matter to be presented in a lesson, I also plan how technology (i.e., computers) can be used to implement the unit Q81: The Computer Initiative has changed my approach to classroom management and instruction Q82: The more I am able to integrate technology (i.e., computers) into the curriculum, the more students are able to manage their own learning.	
Critical Factors (Items that predict the profile)	**Year 2 Results** 82% of Variance explained by:	**Year 3 Results** 78% of variance explained by:
	Q51: Goals for the integration of computers into my teaching practices are clearly defined. Q93: Students have improved in their completion of class assignments since the Computer Initiative was introduced. Q73: I discuss technology, ideas and resources with other teachers. Q52: I spend less time lecturing to the entire class. Q21: The degree of perceived support from the technology assistant. Q32: The degree to which mastering math skills is an objective of computer use. Q44: The degree to which improving problem solving skills is an objective of computer use. Q14: The training I received this year. . .on content software was adequate. Q107: The degree to which the network being down is a barrier. Q45: The degree to which improving student directed learning is an objective of computer use. Q7: Teaching a multi-grade class. Q33: The degree to which learning to apply math is an objective of computer use.	Q73: I am satisfied with the progress I have made since the beginning of the computer initiative. Q75: I discuss technology, ideas, and resources with other teachers Q96: There is an improved student/teacher rapport since the computer initiative was introduced. Q24: The degree of perceived support from the principal. Q111: Enough hardware is available. Q3: Undergraduate major. Q76: The computers have been helpful to me in managing grades.

Note1. Strong agreement with each statement is assumed to represent positive movement toward initiative success. Ideal scores for teacher behavior is 5. For example, if a teacher were to answer items 79-82 with ?strongly agree,? that teacher would have a critical factor score (CFS) of 5 points, a point for each instance of strong agreement. The difference between the CFS and the ideal critical factor score (ICFS) for teacher behavior (i.e., 5) would be 0 or a perfect match with the ICFS and more conducive to computer integration when compared to their counterparts with larger CFSs.

Note2. A multiple regression was employed for these analyses. The criteria for selection was $p < .05$. The above items account for 78% of the variance in the teacher behavior CFSs in this sample. Survey items used to develop the teacher behavior profile were excluded from this analysis. Generally, items included in the equation earlier account for more variance initially. The model / profile is completed when the addition of further items DO NOT account for any more significant amount of variance or predictability in the critical factor scores for teacher behavior.

As seen in Table 9, the most powerful predictor of the positive teacher instructional behavior profile is the discussion of technology, ideas, resources with other teachers. An important secondary predictor is assistance provided by a technology assistant and the principal. It appears that as teachers gain confidence in their ability to implement computers into their instructional routines the interaction they have with other teachers is the most powerful motivator for them to search for resources, integrate technology into their unit and daily planning, change their approach to classroom management and instruction, and provide them with a feeling that they are better able to assist students in managing their own learning. Therefore, time for these collegial interactions should be provided on a regular basis, perhaps at grade level efforts. This strategy is particularly important because of the perception of teachers that not enough planning time is available to integrate technology into their instructional routines.

Conclusions

The common hope of most educators is that technology will result in increased academic performance, practical and cognitive skill development, preparation for the "real world" workplace, and developing self-reliant students. It was also expressed that there was a desire to make students more information savvy, that is, to have students be able to be intelligent consumers of information, information that increasingly is becoming available at the stroke of a key. They believe that the focus should be on knowledge acquisition through total integration, not the computer.

It is readily apparent that teachers participating in this Initiative believe that the computer's role is necessary, and rather crucial, for transforming and improving instruction. They believe technology in general is an integral instructional tool which they must master. It is seen as "cutting edge" instruction, as well providing the connection for their students to world outside the classroom. Technology is increasingly seen as a valuable tool–a tool that may become in the future as invaluable and prevalent as a pencil is today.

As valuable as this tool is to their ability to improve their instructional behaviors, teachers emphasize that they have had to expend an almost overwhelming amount of energy to master the use of computers in their classrooms. However, the study demonstrates that school district efforts to provide teachers with tools and appropriate staff development opportunities, along with individual teacher commitment to master

the new tool, can dramatically and quickly (three years) overcome teacher incapacity to integrate computers into their instructional delivery. In fact, non technology-using teachers were eliminated after the first year of the initiative. And, previous computer and teaching experience was equalized and was no longer a determining factor in predicting a teacher's capacity to use computers in the classroom. By the third year, close to fifty percent (50%) of the teachers classified themselves as advanced meaning that they can perform numerous tasks on the computer such as word-processing, graphics, and information management quite well and are familiar with the software's capabilities. Another twenty-seven percent (27%) of the third year teachers classified themselves as accomplished computer users meaning they know a great deal about computer software and hardware and can perform many tasks using a variety of software. Therefore, by the end of the third year of the Initiative, seventy-seven percent (77%) of the elementary teaching force were capable of infusing technology into their instruction as opposed to twelve percent (12%) of the teaching force before the project began. However, while teacher knowledge of the instructional side of the Initiative greatly improved each year, their knowledge of the technical side of the Initiative is still relatively weak by comparison. This remains an important factor since forty (40%) of them reported that their technical knowledge is the most difficult barrier to implementing the initiative.

Second, teacher capacity to integrate technology into the curriculum is also related to the student's ability to manage their own learning. This requires teachers who:

- enjoy working with students on the computers;
- are aware of the creative uses of computers;
- discuss technology, ideas, and resources with other teachers;
- believe they can call on colleagues without hesitation when help is needed;
- focus their Instructional objectives on improving (1) language arts, (2) mastering and applying math skills, and (3) problem solving and student directed learning; and,
- focus their instructional behaviors on (1) clearly defining goals for integration of computers into their teaching, (2) trying out new techniques to optimize learning, (3) spending less time lecturing and with whole class practicing or reviewing material, and (4) using a thematic approach across subjects.

The findings revealed that these behaviors were being achieved. By the end of third year, teachers' satisfaction increased concerning: (a) their work with students on computers, (b) their increased knowledge about technology, (c) the importance of the Initiative to teacher work, and (d) their progress thus far. This satisfaction is reflected in the teacher held beliefs that the school district is getting the most out of Initiative, and that it is worth the cost and time.

The data were conclusive that teachers used the computers as a tool to improve their instructional delivery. In fact, teacher reaction to computers in their classrooms continued to be overwhelmingly supportive through the three years of the study. They continue to see the computers a very important to their work as a classroom teacher. For example, ninety-seven percent (97%) of all teachers agree or strongly agree that the Initiative is very important to their work as a classroom teacher. Furthermore,

teacher integration of the technology into their instructional strategies seem to be less complicated than in year three than in year two. For example, fewer teachers (20%) in year three perceive that the Initiative required too much of them than teachers (28%) reporting in year two.

Additionally, teachers used the computers as a tool to improve their instructional delivery. They do not see computers as replacing teachers. The primary teacher objective in using the computers was to (a) improve language arts, reading, and writing skills; (b) reinforce and extend the core curriculum; and, (c) motivate interest rather than reward completed work. To a lesser degree, teachers used the computers to improve (a) mathematics, (b) social studies, and (c) science. As the implementation of the Computer Initiative proceeded, teachers placed more emphasis on using the computers to: (a) challenge high-ability students, (b) motivate student interest, (c) improve student directed learning, and (d) remediate deficiencies. They also placed significantly less emphasis on using the computer to reward students for completing their work.

Third, teachers also make the point that the journey to becoming an accomplished integrator of technology is physically and mentally draining and complex. They point to numerous hours that must be spent in first understanding the computer and its capabilities, and then how to integrate it into their instructional strategies. Until they get to the point that they can automatically incorporate the technology as they plan

their lessons, they probably do not have the developed confidence that technology is not a transparent tool. Yes, not only must the technology be transparent, but so must the teacher's use of technology. It is analogous to an English speaking person learning a second language. Until the learner can think in the second language their will always be doubt in their ability.

Teachers indicated that beyond staff development, the most important supports they have are discussions they hold with their colleagues about the use of computers in instruction. Interestingly this collegial support does not translate into collaborative planning among teachers in this study. Perhaps it is too early in the developmental cycle, or other supports are missing.

A secondary teacher support are the administrators. This support, in its positive form, takes the form of recognition of their successes and their interest in how teachers are using the computers in instruction. It may be as simple as a principal saying, "tell me what instructional objectives you are trying to accomplish with computers." Or, "how can I support your efforts." On the other hand, is the negative form of administrative support as evidenced by reduction in planning time. This can result in a "chilling" effect on the teachers perpetuating the struggle to develop new skills and strategies. For example, teachers perceived lack of planning time as the major barrier to fully exploiting the use of computers to improve instruction and student outcomes. Teacher perceptions on this issue increased each year of the study. Obviously, as teacher

capacity to use computers more effectively increased, their frustration with lack of planning time also increased.

Fourth, the complexities of the integrating computers into their instructional repertoires was illuminated by the researchers' observations of the number of decisions that teachers must make to integrate the computer into their instructional plans and their classroom management. In fact, the most important decisions may be those that result in a smooth classroom performance of the teacher. Should I use stations or some combination? If yes, how many stations should I use? What lessons should be incorporated into the stations? How often should I rotate students at the stations? Or, should I use a discovery approach rather than a structured stations approach? It is not surprising that when complexities exist, teachers turn to those they trust – other teachers for advice and support.

Finally, although the use of computer applications outside of education has led to reductions in paper work and routine functions of workers, apparently teacher respondents did not believe that the computers positively improved their routine work tasks such as grading, record keeping, writing letters and planning.

Implications for Further Research

A great deal of data was collected over the three year time period, which lend to a variety of analyses. There arise several possibilities and implications for further

research in this area of technology. Possible studies could include a close examination of school cultural factors and climate, in relation to a school division's readiness for a large scale technology initiative. Additionally, further research might include an examination of the differences and similarities between the schools with the most proficient students and the schools with the least proficient students. In this case the researcher would be looking for significant differences in student and teacher behaviors, motivation, and performance.

Moreover, how an administrator supports and impacts teacher performance and student behavior could provide the basis for a future study. Additional research may also include studying the age/generation factor of the teacher as it relates to computers and attitude, motivation, and performance. Finally, rather than basing students' behaviors and performance on teachers' perceptions, perhaps using a standardized technology component to assess ability may be more appropriate. By using student performance-based assessments on a random sample across the school division, a researcher may be better able to draw accurate conclusions.

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Appendix A

Computers in the Classroom Initiative: A Survey

In the past two years, teachers at your school completed a survey about their experience with computers. We learned much from the responses to those surveys and ask that you provide us feedback just one more time! Having input for the first three years of the elementary school initiative is an important cycle. A copy of the Executive Summary from last year is enclosed for your information. Please wait to read this summary until after you complete the survey.

The survey was shortened a little from last year. However, we need your input on many topics so the survey is still long! We will give much attention to your responses to the questions/statements on the following pages. We will also carefully review any additional feedback that you write on the accompanying comment sheet. Your responses will be totally anonymous; there is no way to trace your responses so you can be candid and constructive.

Most of the responses should go on the accompanying blue "GENERAL PURPOSE ANSWER SHEET." Please mark this sheet with a No. 2 pencil. (Do not mark your name or other identifying information on the answer sheet.)

This material is coming to you in an envelope that can be used to return the answer sheet and comments to us on the county Pony. Please return your responses to Research & Planning Department on the Pony by May 22, 1998.

We have made arrangements with the Metropolitan Educational Research Consortium (MERC), based at VCU, to assist in this survey which explains why their name is found below.

WE THANK YOU FOR YOUR ASSISTANCE AND PROFESSIONALISM IN COMPLETING THIS SURVEY.

A Survey prepared by the
Metropolitan Educational Research Consortium (MERC)
for Henrico County Public Schools

Section 1. Teacher Background, Teacher Experience, Support, and Training

1. Gender
   A. male B. female

2. Ethnic Group
   A. Caucasian
   B. African/American
   C. Asian
   D. Hispanic
   E. Other:_____

3. Undergraduate major degree in
   A. education
   B. liberal arts
   C. psychology
   D. science
   E. other:_____

4. Number of years teaching
   A. 2 years or less
   B. 3 - 5
   C. 6 - 9
   D. 10 - 13
   E. 14+

5. Computer at Home for Personal Use
   A. Yes B. No

6. Number of Years you have Used Computers in Teaching
   A. 2 years or less
   B. 3 - 5
   C. 6 - 9
   D. 10 - 13
   E. 14+

7. What grade do you teach (if more than one grade, mark lowest grade)?
   A. First
   B. Second
   C. Third
   D. Fourth
   E. Fifth

8. How many students are in your class?
   A. Less than 20
   B. 20 - 25
   C. More than 25

Section 2. Questions 9 through 12 deal with How You Receive Training to use Computers.

Personal Training, Etc.

9. Self-taught (e.g., practice on the computer at home)
   A. yes B. no

10. Classes, conferences, and workshops (on own time)
   A. yes B. no

11. Instruction from other teachers
   A. yes B. no

12. Instruction on site by technology instructor
   A. yes B. no

For items 13 through 18 fill in the response that best reflects your level of agreement with the item, using the response modes below:

		Strongly Agree	Agree	Dis-agree	Strongly Disagree
13.	I benefited greatly from the 2 days of technology training this year.	A	B	C	D
14.	I benefited greatly from the ½ day technology planning session held at my school	A	B	C	D
15.	The courses offered by my school system meet my needs.	A	B	C	D
16.	Technology workshops/courses held at my school met my needs.	A	B	C	D
17.	Instruction offered on-site by the technology instructor meets my needs.	A	B	C	D
18.	The computer initiative has motivated me to grow professionally.	A	B	C	D

Section 3. Questions 19 through 24 deal with rating the support you receive from various sources.

(Rate: "A"=excellent support to "D"=no support, and "E"=don't know) For the items below indicate the amount of support received.

(A)= excellent support (there when you need it / proactive)
(B)= average support (there when you ask for it / reactive)
(C)= less than average support (not there when needed or asked)
(D)= no support
(E)= don't know

19. Other teachers (day to day)

20. School computer contact

21. Technology Support Technician (TST)

22. Technology instructor (conducts training, introduces software, helps with technology integration efforts, etc.)

23. Technology assistant (corrects technical problems)

24. Principal

For items 25-28: Please answer the following questions dealing with several aspects of computer use.

25. Have you received adequate technical support?
A. yes B. no

26. Have you received adequate instructional training support?
A. yes B. no

27. Which statement best describes your level of <u>Computer Expertise TODAY</u>?

A. non-user

B. I can only perform simple tasks on the computer and with some difficulty.

C. I can perform basic computer tasks (e.g., word processing) quite well, although I might not know or utilize the full potential of the program.

D. I can perform numerous tasks on the computer (e.g., word processing, graphics, information management etc.) quite well and am familiar with the software's capabilities.

E. I know a great deal about computer software and hardware, and can perform many tasks using a variety of software.

28. In your opinion which item below BEST describes the POTENTIAL role of computers in classrooms.

A. Replacing teachers (computers become the "teachers," teaching lessons and giving computerized tests, etc.)
B. Implementing (a tool for teaching that will enhance instruction, but not drastically change it.)
C. Transforming (teachers facilitate learning; they do not lecture, there is a great impact on changing the teacher's role and school structure.)

Teaching Practices

Section 4. Why do you use it?

Questions 29 through 33 deal with the **Goals of Most of your Computer Work** and you are to select one choice only for each item. What do you use computers for in your classroom? What is your first goal, your second, and your third goal, etc. concerning computer use in the classroom? (Mark only one A, one B, one C, or D for questions 30, 31, and 32). **READ ALL ITEMS BEFORE RESPONDING.**

A. most important goal
B. primary goal
C. moderate goal
D. least important goal

29. Introduce new concepts (e.g., prepare students for instruction on a topic by using an appropriate software package)

30. Reinforce core curriculum (e.g., provide students with extra practice on material already learned)

31. Extend core curriculum (e.g., provide additional information on a topic)

32. Remediate core curriculum (e.g., provide an appropriate software package for students who need additional help)

33. In general which description below BEST matches what your students use computers for most in your class?
A. Text processing tools (e.g., word processing)
B. Instructional Software (e.g., WorldGeograph and Bodyscope)
C. Analytical or Programming tools (e.g., Hyperstudio and spreadsheets)
D. Games
E. I use a variety of the categories of software listed above

Section 5. Objectives for Computer Use

Questions 34 through 47 deal with the objectives for computer use in the classroom.
For the items below Rate the degree that each item is an objective of computer use in your classroom. For example, if the item is "Entertainment" and if this is not an objective it would be marked as "D" on the response sheet, use this response mode for rating items 32-45 below).

A. primary objective
B. moderate objective
C. low objective
D. not an objective

		Primary Objective	Moderate Objective	Low Objective	Not an Objective
Subject areas					
34.	Mastering math skills	A	B	C	D
35.	Learning to apply math	A	B	C	D
36.	Improving language arts skills	A	B	C	D
37.	Improving reading skills	A	B	C	D
38.	Improving writing skills	A	B	C	D
39.	Understanding social studies	A	B	C	D
40.	Understanding science	A	B	C	D
General areas					
41.	Motivating interest	A	B	C	D
42.	Rewarding completed work	A	B	C	D
43.	Challenging high ability students	A	B	C	D
Learning and skill areas					
44.	Remediating deficiencies	A	B	C	D
45.	Improving higher order thinking skills	A	B	C	D
46.	Improving problem solving	A	B	C	D
47.	Improving student directed learning (e.g., students use software to explore, discover, and construct their own learning)	A	B	C	D

Section 6. **SINCE I HAVE BEEN USING COMPUTERS in my classroom, how has my teaching environment changed?**

For the items 48 through 61 below, indicate the degree to which you agree or disagree with the statement. The response mode for the scoring sheet is as follows:

		Strongly Agree	Agree	Dis-agree	Strongly Disagree
General areas					
48.	I can expect more from my students in terms of their pursuing and editing their work.	A	B	C	D
49.	I am more comfortable with small group activities.	A	B	C	D
50.	I have an awareness of the creative uses of computers in education.	A	B	C	D
51.	I feel that my colleagues are excited about computers in the classroom.	A	B	C	D
52.	I am encouraged at my school to try new ways to use computers in my teaching.	A	B	C	D
53.	Goals for the integration of computers into my teaching practices are clearly defined.	A	B	C	D
Class time					
54.	I spend less time lecturing to the entire class (e.g., whole group instruction).	A	B	C	D
55.	I spend less time with the whole class practicing or reviewing material.	A	B	C	D
Teaching style					
56.	I am better able to present more complex material to my students.	A	B	C	D
57.	I utilize a thematic approach across subject areas.	A	B	C	D
58.	I use learning stations in my instruction.	A	B	C	D
59.	I use small group activities in my instruction.	A	B	C	D
60.	Trying out new techniques in instruction is needed for optimizing student education.	A	B	C	D
61.	I use computers throughout my instruction (e.g., whenever there is appropriate software).	A	B	C	D

Section 7. Overall Perceptions

		Strongly Agree	Agree	Dis-agree	Strongly Disagree
Staff Development - Administrative Support					
62.	The elementary specialists provide support for technology integration and provide suggestions.	A	B	C	D
63.	Fellow teachers provide a good source of support.	A	B	C	D
64.	My principal provides feedback concerning my efforts to integrate computers into instruction.	A	B	C	D
65.	My perception is that parents are supportive of computers in the classroom.	A	B	C	D
66.	I can ask colleagues for help with technology when needed without hesitation.	A	B	C	D
67.	I have good support from the administration.	A	B	C	D
Attitudes					
68.	I enjoy working with my students on computers.	A	B	C	D
69.	The computer initiative has increased my interest in and knowledge about technology.	A	B	C	D
70.	I consider the computer initiative as being very important to my work as a classroom teacher.	A	B	C	D
71.	I feel that my school is getting the most out of the computers in the classroom.	A	B	C	D
72.	I feel that the computer initiative is worth the cost and time.	A	B	C	D
73.	I am satisfied with the progress I have made since the beginning of the computer initiative.	A	B	C	D
74.	I feel that the computer initiative requires too much of me.	A	B	C	D
Technology Use					
75.	I discuss technology, ideas, and resources with other teachers.	A	B	C	D
76.	The computers have been helpful to me in managing grades.	A	B	C	D
77.	The computers have been helpful to me in managing student information.	A	B	C	D
78.	The computers have allowed me to better produce products such as newsletters.	A	B	C	D

		Strongly Agree	Agree	Dis-agree	Strongly Disagree
Instructional Behavior (Teacher Work Behavior)					
79.	The computer initiative has encouraged me to plan cooperatively with other staff.	A	B	C	D
80.	As I plan for the subject matter to be presented in a lesson, I also plan how technology (i.e., computers) can be used to implement the unit.	A	B	C	D
81.	The computer initiative has changed my approach to classroom management and instruction.	A	B	C	D
82.	The more I am able to integrate technology (i.e., computers) into the curriculum the more students are able to manage their own learning.	A	B	C	D
83.	I use the Henrico County Teacher Resource Guide for lesson plan ideas.	A	B	C	D
Motivation (Student Work Behavior)					
84.	There is an increase in student motivation to read since the computer initiative was introduced.	A	B	C	D
85.	There is an increase in student motivation to write since the computer initiative was introduced.	A	B	C	D
86.	There is an increase in student motivation to learn since the computer initiative was introduced.	A	B	C	D
87.	Student attention has improved since the introduction of the computer initiative.	A	B	C	D
88.	There is an increase in student motivation to understand math since the computer initiative was introduced.	A	B	C	D
Performance					
89.	My high-achieving students have profited from the computer initiative.	A	B	C	D
90.	My average-achieving students have profited from the computer initiative.	A	B	C	D
91.	My low-achieving students have profited from the computer initiative.	A	B	C	D
92.	Students have improved in their completion of class assignments.	A	B	C	D
93.	Students have improved in their research skills.	A	B	C	D

		Strongly Agree	Agree	Dis-agree	Strongly Disagree
94.	Students have improved in their completion of homework assignments since the computer initiative was introduced.	A	B	C	D
95.	Discipline problems in my classroom have decreased since I began using computers in my teaching.	A	B	C	D
96.	There is an improved student/teacher rapport since the computer initiative was introduced.	A	B	C	D
97.	The grades of my students have improved because technology was introduced.	A	B	C	D
98.	Students have improved in their ability to work cooperatively with other students since the computer initiative was introduced.	A	B	C	D

Questions 99 through 113 ask you to rank your perceptions of the impact of barriers to using the computers effectively.

Section 8A. Examine the CURRENT barriers to most effectively using the initiative classroom computers. Use each rank only once in items 99-103.

(Look over all the items in the category and then rank them. Rank: "A"=most difficult barrier to "E"=least difficult barrier)

A. most difficult
B. more than moderately difficult
C. moderately difficult
D. less than moderately difficult
E. least difficult

Instructional Delivery

99. Not enough time to develop lessons that use computers

100. Not enough help for supervising student computer use

101. Not enough training to learn how to fully integrate software

102. My knowledge of computers is still too weak to use them effectively.

103. Lack of appropriate software

Section 8B. Examine the CURRENT barriers to most effectively using the initiative classroom computers. Use each rank only once in items 104-108.

(Look over all the items in the category and then rank them. Rank: "A"=most difficult barrier to "E"=least difficult barrier)

A. most difficult
B. more than moderately difficult
C. moderately difficult
D. less than moderately difficult
E. least difficult

Hardware

104. Computers need to be repaired too frequently.

105. There are frequent problems with printers

106. The network is down too often.

107. I don't understand the technical side of the initiative.

108. Response to computer repair is too long.

Section 8C. Examine the CURRENT barriers to most effectively using the initiative classroom computers FOR INSTRUCTION. Use each rank only once in items 109-113.

(Look over all the items in the category and then rank them. Rank: "A"=most difficult barrier to "E"=least difficult barrier)

A. most difficult now
B. more than moderately difficult now
C. moderately difficult now
D. less than moderately difficult now
E. least difficult now

109. Not enough time in the school schedule for computer-based instruction.

110. Not enough software available.

111. Not enough hardware available.

112. Not enough planning time.

113. Lack of building level leadership.

Many thanks are extended to you for pursuing this survey to the end. Your responses are extremely important.
FORMA98.HEN

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